

REMARKS

Claims 1-17 are pending in the application. Claims 1-14 have been withdrawn.

New dependent claims 18-43 have been added. Support for these claims can be found in originally filed claims 2-14.

No new matter has been entered.

Rejections Under 35 USC 103

The Examiner has rejected claims 15-17 as obvious over Baird et al (WO 02/07881) in view of Tsao et al (US 2002/0121457). The Examiner contends that Baird discloses a method of converting hydrocarbons by adding noble metal catalyst to a hydrocarbon composition to effect ring opening and manufacturing the noble metal catalyst by a process comprising (a) using a acid medium or large pore zeolite support having acid sites, (b) depositing a noble metal (platinum, palladium, iridium and mixtures and combinations thereof) by vaporizing a noble metal precursor of organometallic complexes such as acetylacetonates (e.g.  $\beta$ -diketonates) and (c) heating at oxidizing or reducing conditions. The Examiner admits that Baird does not specifically disclose pre-treatment and optional modification of the support.

To fill this void the Examiner turns to Tsao *et al.*, which he contends disclose a process similar to Baird for selective naphthenic ring opening of diesel fuels using a similar noble metal catalyst supported on a large pore zeolite. The Examiner also contends that Tsao *et al.* disclose modification of the zeolite with steam at a temperature of about 823-1088°K to maintain the alpha acidity to the desired level.

The Examiner also admits that Baird *et al.* do not disclose vaporization of noble metal precursor by gas phase technique, but contends that Baird *et al.* do disclose that the addition of metals from Group VIII to the support material can be accomplished by conventional techniques and that Tsao *et al.* also disclose that a Group VIII metal component can be incorporated by any

means known in the art. From all of this, the Examiner concludes that it would have been obvious to one skilled in the art to modify the Baird *et al.* invention and modify the zeolite by heating as disclosed by Tsao *et al.* to maintain the alpha acidity to the desired level.

With respect to claim 16 which requires middle distillate diesel fuel reacting in a reactor at 283-673oK under 10-2—bar pressure with hydrogen, the Examiner again points to Baird *et al.*'s disclosure of temperature and pressure with hydrogen in a reactor.

The Examiner also cites Lasdaf *et al.* for deposition of palladium and ruthenium  $\beta$ -diketonates on alumina and silica supports in gas and liquid phase and a standard deposition technique.

Applicants respectfully traverse.

Applicants first note their understanding of the Baird *et al.* method. To summarize, Baird *et al.* describes a catalyst containing a noble metal and a support which is a composite formed of an alumina component and molecular sieve (aluminum silicate). According the description the molecular sieve is a faujasite-type zeolite (ECR-4, ECR-30, ECR-32, ECR-35). The noble metal is Ir or Ir together with another noble metal (Pt, Pd, Rh or Ru). The addition of the noble metal is carried out using conventional methods, with incipient wetness impregnation or absorption from an aqueous solution. Alternatively, the addition of the noble metal may be carried out from an organic solvent using an organometallic complex such as acetylacetonate, followed by thermal decomposition of the noble metal complex under air, hydrogen or inert atmosphere.

The method for the manufacture of the catalyst in Baird *et al.* differs from the method of the pending claims with respect to the following features:

- Baird *et al.* are silent about any pre-treatment of the support
- Baird *et al.* are silent about any optional modification of the support

- In Baird *et al.* the addition of the noble metal is carried out from a solution, whereas in the claimed method the noble metal is deposited using gas phase deposition comprising vaporization of the noble metal precursor selected from  $\beta$ -diketonates and metallocenes
- In the claimed method the noble metal precursor reacts with the support. In Baird *et al.* the noble metal compound is added as a solution typically at room temperature. At low or moderate temperatures no reactions between the support and the noble metal compounds take place. Noble metal acetylacetonates require temperature of around 200°C to react.

Applicants' understanding with respect to Tsao *et al.* is as follows. Tsao *et al.* disclose a noble metal catalyst on a support that is a large pore crystalline molecular sieve having faujasite-structure and low acidity (such a USY). The noble metal comprises Pt, Pd, Ir or Rh or combinations thereof. Tsao *et al.* disclose modification of the support, which means dealumination of the zeolite support by steam, whereby the acidity of the zeolite is adjusted to sufficiently low level in order to minimize cracking and isomerization occurring in connection with ring-opening.

Generally Tsao *et al.* disclose that the addition of the noble metal can be made by any means known in the art, however, taking into account that because of the dealumination of the zeolite support, there are only limited number of ion exchange sites available. Tsao *et al.* suggest carrying out the addition of the noble metal by impregnation or by cation exchange, either from an inorganic aqueous solution or an organic alcohol solution. Finally, the catalyst is dried and calcinated under air.

In addition the method for the manufacture of the catalyst of Tsao *et al.* differs from the claimed method with respect to the following features:

- Tsao *et al.* are silent about any pre-treatment of the support

- Modification of the support in Tsao *et al.* refers to adjusting the acidity of the zeolite by steam dealumination of the zeolite. The optional medication in the pending claims refers to adjusting the noble metal content to a lower level by adding a “blocking reagent” on the support before the reaction with the noble metal precursor.
- Tsao *et al.* are silent about any organometallic compounds
- Tsao *et al.* are silent about any reactions of organometallic compounds in gas phase with a support

Neither of the references refers to any gas phase method. Baird *et al.* suggest adding the metal by conventional techniques and Tsao *et al.* also suggest using conventional method, such as impregnation or cation exchange. **A gas phase method cannot be regarded as “a conventional method” because it is not used as a general method in this field of art for either research or industry.** Furthermore, reacting of the metal precursor with the support as required in the instant claims is a special embodiment of the gas phase reaction which is not referred to at all in the cited references. Based on the teachings of these two references it is clear that the skilled artisan would not have selected **any** gas phase method. Because of this, a skilled artisan would not have had a reasonable expectation of success in obtaining the claimed method by combining the disclosure of the cited references.

The Examiner also refers to Lashdraf *et al.*, which as Applicants understand it, relates to the manufacture of Pd and Ru catalysts from gas phase on alumina and silica supports. However Lashdraf *et al.* are silent about the manufacture of Pt or Ir catalysts from gas phase on zeolite supports. Here, each case and combination requires unique stable reagents which can be maneuvered in gas phase and which react on the surface of the support without substantial decomposition. The micropores of zeolites and the stronger acidity of the adsorption sites (i.e. acid sites) pose essentially different challenges for the manufacture of catalyst material when compared to mesoporous alumina and silica containing no strong/medium-strong Bronsted

acidity. Thus the teachings of Lasdaf *et al.* cannot be used as such to arrive at the present invention.

In summary, none of the references teaches the addition of noble metal compounds in gas phase to a zeolite support. Furthermore, one cannot contend that the interaction of a noble metal compound with a support is the same independently from temperature. That is, the reaction between a noble metal compound and a support will depend upon the temperature to which the two components are exposed. This is supported by the comparative examples (Examples 1-4) which are carried out using a conventional "wetness impregnation" method and the inventive examples (Examples 5-7) which use the "gas phase deposition" method.

Therefore, in view of the above, Applicants request reconsideration and removal of the rejections.

#### Conclusion

In view of the above remarks, all the claims remaining in the case, including newly added claims, are submitted as defining non-obvious, patentable subject matter. Reconsideration of the rejections and allowance of the claims are respectfully requested.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Susan W. Gorman, Registration No. 47,604 at the telephone number of the undersigned below.

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Respectfully submitted,

LRS/SWG/awl